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The White House  
Washington, D. C.

February 19, 1960

Memorandum for:

Mr. C. W. Ames  
Dr. Harold Brown  
Mr. Philip Farley  
Dr. James Fletcher  
Mr. W. E. Gehrig

Dr. Donald Hornig  
Dr. Franklin Long  
Mr. John Rubel  
Dr. Herbert Scoville  
Admiral John Sides  
Dr. Charles Townes  
Dr. Albert D. Wheeler

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Attached is a second cut at the conclusions of the Ad Hoc Study Group.

With the exception noted below, an attempt has been made to bring these conclusions into better consonance with the views of the group as expressed in the meeting of 11 February.

However, conclusions 2 and 3 of the section on implications is novel, since it did not occur to the undersigned until the day following the meeting. A careful examination of these conclusions has failed as far to indicate a flaw in the argument. The statement of these two conclusions has been deliberately made longer than a probable final version in order to expose more fully to the members of the group the underlying logic. The validity of this logic will form an item of discussion for the next meeting.

The next meeting of the Ad Hoc Group will take place at 9:30 a.m. on Saturday, February 20, in Room 272-1/2 of the Executive Office Building. Attendance on the part of members of the Missiles Panel is welcomed but optional. At least their comments on the attached document are solicited.

D. P. Ling  
G. W. Rathjens

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## CONCLUSIONS

### 1. Conclusions relating to feasibility of a test ban.

1. Because of the impermanence of the effects associated with the firing of ballistic missiles, the detection process has to be implemented in a period of time comparable with that of the duration of the flight.

2. A system of U.S. or internationally operated radar sites deployed throughout the Sino-Soviet Bloc would constitute a high-confidence method of detecting ballistic missile flights within the Bloc. The number of radars required depends on the maximum altitude of the missile. For an apogee of 140 nm (corresponding to a normal ground range of 560 nm), six such sites would be required, and certain additional back-up instrumentation at each site would be desirable.

Three radars, two in the continental U.S. and one in the Pacific, would suffice for Soviet monitoring of U.S. land-based firings.

3. Certain current developments--particularly acoustic and possibly radio backscatter systems--now in their exploratory stages offer promise, when used cooperatively (and in conjunction with radar) of a satisfactory peripheral detection system. It is not possible at the present time to specify the confidence level

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-2-

to be attached to such a system, either with respect to their certainty of detection or with respect to their immunity to false alarms.

4. The testing of IRBM's and small ICBM's at sea is a possible operation. A world-wide radar detection system of high confidence is feasible, but would involve the order of 50 radars and would be correspondingly expensive. The cooperative use of the acoustic and backscatter techniques might constitute a relatively inexpensive world-wide detection, but it is premature to assign a confidence level to it at this time. An "inspection team" system with unrestricted access to Sino-Soviet shipyards, ports and shipping would entail the use of about qualified people, and probably would not by itself constitute a high confidence system.

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[redacted] which may be implemented in any event as a measure of early warning, has the potentialities of a world-wide detection system. It is not possible at present to determine whether it would by itself satisfy the requirements of such a system.

6. Of the various detection systems above, only the radar system would have any capability of distinguishing a missile firing from a space flight. None would have any capability at all for determining

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-3-

whether a space flight were being used primarily to further missile development. Consequently, it would be necessary to establish, in both the U.S. and the USSR, monitor teams--possibly international in constitution--having broad powers of inspection of space vehicles and payloads, including access to the firing site and its data sources.

II. Conclusions relating to the feasibility of a ban or limitation on production.

I. A qualifiedly\* effective system for delimiting Sino-Soviet production of missiles could be implemented if, and only if, the following conditions could be met.

a) An inventory by the signatories of the entire sino-Soviet industrial complex prior to the implementation of the ban. Such an inventory could probably be done in about a year and would involve the services of two or three thousand qualified people.

b) An acceptance by the USSR of the principle of "total access". This involves:

- i) Unrestricted right to low altitude aerial reconnaissance
- ii) Right of inspection teams to immediate, unrestricted and self-initiated access to and examination of all missile-associated facilities, both declared and undeclared, and to all suspect areas of any nature whatever.

\*Later conclusions supply the qualifications.

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-4-

2. Inspection teams to perform the monitoring function would be tied in with the U. S. intelligence activity. The teams could be organized in a variety of ways (see Annex 1). A probable minimum acceptable number of 1000 qualified people (exclusive of housekeeping) would be engaged in this activity. Their continuing effectiveness, as indicated earlier, would be contingent on the prior inventory of Soviet industry.

3. Despite inspection of the sort envisaged here, there would remain the possibility of a small clandestine flow of illicitly produced missiles. The order of one or two missiles a month might represent a relatively low-risk operation on the part of the USSR, while five or more a month would probably constitute a high-risk situation.

The finite chance of discovery and exposure, and the grave political consequences of exposure would constitute a serious deterrent to the USSR in attempting such covert production. However, in the event of a serious curtailment of production rates and stockpile levels the incentive to cheat would be particularly great.

III. Conclusions relating to the effect of a space program on the effectiveness of a test ban.

1. In the event of a test ban, Soviet space experimentation could provide a certain feed-through to the advantage of their missile capability. Certain of this feed-through would be quite difficult

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-5-

to circumvent. Examples are:

- a) Increased reliability through continuing experience in handling and firing large rocket engines.
- b) Improvements in guidance accuracy.

The first of these examples is probably not of great significance, the latter might be of considerable importance.

Such improvements as the above are by no means contingent on the existence of a space program, but they would certainly be facilitated by it.

2. It is quite conceivable that new missile configurations (e.g., solid propellant boosters) or new subsystems (e.g., all-inertial guidance) developed and tested in the course of space operations might find their way into the Soviet missile stockpile. Such developments would enjoy greatly reduced confidence in the presence of a test ban, but the lack of confidence would not necessarily constitute complete unacceptability.

3. (Conclusion on the possibility of imposing controls or restrictions on space flight operations so as to minimize feed-through to the military program.)

#### IV. Conclusions relating to the implications of a test ban.

1. If a test ban were implemented in January 1961, the only ICBM

-6-

that could be deployed in which the U. S. would have high confidence would be the soft, radio-inertial Atlas. An operational Polaris force, with 1200 nm missiles only, would be possible; confidence in it would be less than in the case of the soft Atlas. A hard all-inertial Atlas capability could be developed, but confidence in it would be even less than in Polaris. The operational deployment of the Titan would be precluded; this would probably imply a smaller (as well as qualitatively different) U. S. ICBM force for the period beginning in the latter half of 1961, than would be the case in the absence of a ban.

2. Even with a January 1961 test ban, the Soviets could probably develop (by about January 1963) an AIRBM system for urban defense against missiles, such as the Polaris, which have very limited capacity for decoys, and which are not well suited for near simultaneous delivery.

3. The Soviets might develop an ASW capability by about 1963, that would make the 1200 nm Polaris quite vulnerable to attack (though this may be more difficult than the aforementioned AIRBM development.).

4. A January 1961 test ban would reduce, but not stop, the rate of improvement in accuracy of Soviet missiles. However, their accuracy will almost certainly be good enough by January 1961 so that any further improvements may be quite unimportant insofar as one is concerned about their ability to attack soft U. S. targets.

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-7-

5. A test ban dated January 1961 would, therefore, be a grave risk to the U.S. since it could lead to a situation a few years hence where we would have no retaliatory capability on which we could depend. Soft missiles (and any aircraft caught on the ground) could be easily destroyed by a Soviet preemptive attack; the Polaris force could possibly be neutralized by Soviet AIRBM and/or ASW developments; any aircraft that may be on air alert may find penetration of Soviet defenses increasingly, and perhaps almost impossibly, difficult with the passage of time; and any hard ICBM capability which might be developed would be one in which there could be little confidence.

6. A test ban implemented in January 1963 would permit the operational deployment of the 100 psi all-inertial Atlas, Titan and Minuteman, of the mobile Minuteman and of the 1500 nm Polaris. Confidence in all should be quite high, a test ban implemented 6 months earlier would probably not preclude development of any of these systems though confidence in the mobile Minuteman and the non-cryogenic all-inertial Titan would probably be significantly lowered.

7. A January 1963 test ban would probably permit the development of a small, mobile, solid or non-cryogenic liquid fueled ICBM by the USSR.

8. By January 1963 Soviet guidance will have improved substantially. A 1963 test ban would reduce, but not stop, the rate of improvement subsequently. It is possible that by January 1963 accuracies and reliabilities

-8-

of Soviet missiles may already be good enough so that the exchange ratio against 100 per U. S. targets may be near unity.

9. A January 1963 test ban would not appear to be particularly dangerous for the U. S., since it would permit development of all U. S. missiles for which there are now firm programs. At this time there do not appear to be any others in prospect that would offer the possibility of significantly improving our retaliatory posture. A ban slightly earlier than January 1963 might be advantageous in that reduction in the rate of improvement of Soviet CEP might more than offset our diminished confidence in the mobile Minuteman. It would seem important that the test ban not be so early as to completely preclude development of the mobile Minuteman in view of the inevitable improvements in Soviet CEP's (even if they are relatively high at the time of the ban).

10. Technological developments, as yet unforeseen, may upset these conclusions, but there does not appear to be any basis for determining whether such developments will make a test ban less desirable or more so. General conclusion with respect to a missile test ban.

11. A missile test ban would be a grave risk to the U. S. if implemented in January 1961. The risk would diminish with deferral. A ban in late 1962 or early 1963 would not appear disadvantageous; moreover, a high confidence, though expensive, radar detection system could be available; it is possible,

-9-

though by no means certain, that alternative, less expensive, detection systems could also be made operational by then.

**V. Conclusions relating to the implications of a production ban.**

- 1. A production ban as early as January 1961 would leave the U. S. with a very few soft fixed missiles, a small Polaris force, and a bomber force whose capability of penetration (particularly in a retaliatory role) might well diminish in time if Soviet defenses continue to be buttressed. The Soviet ICBM force could sufficiently outnumber their aim points in the U. S. so that only certain warning (which would be available after late 1961 at best), and great speed of response on our part could hope to leave us with any significant retaliatory capability. In addition, the generally low levels of inventory on both sides would lead to a danger from small levels of clandestine production.**
- 2. A symmetric limitation on production where the allowed production rate exceeded by several times the estimated clandestine production increment would lead to a situation after a year or so where the missile inventories of the two sides would be in a proportion such that neither side's force would be sufficient to destroy the bulk of the adversary's force. The allowed production rate would also have to be sufficiently large so that the aforementioned approximate parity would be achieved before the U. S. bomber force was made nearly ineffective by air defense. These considerations suggest that a**

-10-

minimum allowed rate of production in the event of a 1961 ban would be about 5 missiles per month. In the event of implementation at a later date the rate might have to be larger, though perhaps not so if disclosure and verification of Soviet ICBM inventory revealed that the ratio of their force size to that of the U. S. was not much greater than unity.

3. In the event of an early production limitation, without a prohibition on missile testing, both sides would probably do limited testing in order to prevent diminution in confidence, to improve accuracy, and to prove out modifications in missiles--particularly improved mobility or hardening. Such modifications would, in the near future, probably increase exchange ratios faster than accuracy improvements would diminish them. Thus, testing, at least up to the point where both sides have quite mobile or hard missiles, would probably lead to a reduction in the level of damage that each side could inflict on the adversary's force. A continuation of testing would seem, therefore, to be advantageous to both sides. Once mobile or hard missiles were operational, the trend might be reversed. Further tests might result in reduced exchange ratios as improvements in guidance became more significant than improvements in hardening. It is possible that one or both sides might consider confidence firings to be of such importance as to override this argument against continued testing. However, there is an added argument, and that is that a test ban would also probably be advantageous to the degree that it might prevent or delay the attainment of

-11-

missile capabilities by powers other than the U. S. and the USSR.

4. If current U. S. schedules are met, a January 1963 production ban would leave the U. S. with about 200 ICBM's and 9 Polaris submarines operational. If Soviet CEP's and force levels were about as estimated in the NIE, a very substantial fraction of the U. S. ICBM's would survive a Soviet first strike. However, it is possible that Soviet capabilities may be such at the time of the ban that less than 10% of the U. S. fixed bases would escape destruction. Even if Soviet CEP's were relatively poor at the time of this production ban, they might improve subsequently, especially if there were no test ban. The Polaris force, plus even a small residue of the ICBM force would pose a very substantial threat to the USSR, though it might be somewhat neutralized by an AIRBM defense. Though a substantial U. S. retaliatory capability might survive a Soviet strike, there would nevertheless be a great advantage in a first strike; the situation would not, therefore, be as stable as one could wish. Thus, a January 1963 production ban would seem to be somewhat risky though perhaps not out of the question.

5. With deferral of the ban until about January 1964, the U. S. Minuteman forces, both fixed and mobile, would have grown so substantially that there would then seem to be little danger in a ban. Alternatively, acceleration of U. S. production schedules would permit a ban with low risk at an earlier date, possibly as early as January 1963.

-12-

6. By 1963 the stockpiles of both sides will be so large, that a limitation of production to a low level, as distinct from a ban, would be far less significant than in 1961. The conclusions with respect to the desirability of a ban are then for the most part appropriate to a limitation in production as well. A limitation would, however, seem slightly preferable in that it would make clandestine production less serious.

7. The arguments presented earlier with respect to the question of a prohibition on testing when there is also limitation on production seem applicable for 1963 or later.

8. With a ban or limitation on production, the development of an AICBM (and AIRBM) defense could be of great importance. A defense to cope with large missiles with substantial decoy capacities would almost certainly require missile tests if there were to be any confidence in it. However, this would not seem to be a strong argument for, or against, test continuation since it is not clear that AICBM defense would improve or diminish stability, or be more advantageous to the U.S. or the USSR.

General Conclusions with respect to a production ban or limitation.

9. An absolute ban on production would seem to be very dangerous if implemented as early as 1961. With delay, the danger would diminish; by January 1963 there might still be a significant risk; by January 1964 (or earlier, if U.S. production were accelerated) the risk would be small.

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-10-

A limitation which permitted production at least several times the estimated clandestine production capability would pose little risk, and would probably be advantageous if implemented as early as 1961. With the passage of time the advantage of a limitation over an absolute ban would diminish in importance. In the event of a productive limitation, a continuation of testing would seem advantageous up until sometime in 1962; thereafter, perhaps disadvantageous. A production ban or limitation could be monitored though it would require disclosure and verification of inventory, and complete access for inspection.

Ling/Ruth/jms/30

13 February 1960